

AT-2

AT-2 12 Channel ECG Unit



Article Number 2.510.512



User Guide



SCHILLER
A M E R I C A

The Art of Diagnostics

CARDIOVIT AT-2

User Guide

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Intended Use

The SCHILLER Cardiovit AT-2 is a 12-channel, ECG device used for the recording, analysis and evaluation of ECG Recordings. Recordings made with the AT-2 can be used as a diagnostic aid for heart function and heart conditions. The unit is designed for indoor use and can be used for all patients of both sexes, all races, and all ages.

Physician's Responsibility

The Cardiovit AT-2 ECG Unit is provided for the exclusive use of qualified physicians or personnel under their direct supervision. The numerical and graphical results and any interpretation derived from a recording must be examined with respect to the patient's overall clinical condition. Patient preparation and the general recorded data quality, which could effect the report data accuracy, must also be taken into account.

It is the responsibility of the physician to make the diagnosis or to obtain expert opinion on the results, and to institute correct treatment if indicated.

FEDERAL LAW IN THE USA RESTRICTS THIS DEVICE TO SALE BY OR ON THE ORDER OF A PHYSICIAN

AT-2 User Guide

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Terms of Warranty

The SCHILLER Cardiovit AT-2 is warranted against defects in material and manufacture for the duration of one year (as from date of purchase). Excluded from this guarantee is damage caused by an accident or as a result of improper handling. The warranty entitles free replacement of the defective part. Any liability for subsequent damage is excluded. The warranty is void if unauthorized or unqualified persons attempt to make repairs.

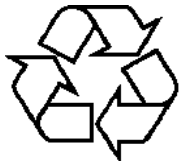
In case of a defect, send the apparatus to your dealer or directly to the manufacturer. The manufacturer can only be held responsible for the safety, reliability, and performance of the apparatus if:

- ° assembly operations, extensions, readjustments, modifications, or repairs are carried out by persons authorized by him, and
- ° the Cardiovit AT-2 and approved attached equipment is used in accordance with the manufacturers instructions.

THERE ARE NO EXPRESS OR IMPLIED WARRANTIES WHICH EXTEND BEYOND THE WARRANTIES HEREINABOVE SET FORTH. SCHILLER MAKES NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE PRODUCT OR PARTS THEREOF.

This equipment has been tested and found to comply with the limits for a class A digital device, pursuant to both Part 15 of the FCC (Federal Communications Commission) Rules and the radio interference regulations of the Canadian Department of Communications. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with this instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Disposal Instructions and Battery Care



- DO NOT DISPOSE OF THE BATTERY BY FIRE OR INCINERATOR - DANGER OF EXPLOSION
- DO NOT OPEN THE BATTERY CASING - DANGER OF ACID BURN

Only dispose of the battery in official recycling centres or municipally approved areas. Alternatively, used batteries can be returned to SCHILLER AG for disposal.

Units no longer required can be returned to SCHILLER AG for disposal. Alternatively dispose of the unit in municipally approved recycling centres.

EMC Complicity

This equipment has been tested and found to comply with the limits for a class A digital device, pursuant to both Part 15 of the FCC (Federal Communications Commission) Rules and the radio interference regulations of the Canadian Department of Communications. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with this instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Power Supply

The mains connection is on the rear of the unit. The power supply voltage is set by the factory for 100-115V(nom. 110V) working. The setting is indicated by the indented metal strip on the fuse panel. Contact your dealer if the voltage needs to be changed.

The mains indicator lamp on the keyboard is always lit when the unit is connected to the mains supply. The unit can either be operated from the mains supply or from the built-in rechargeable battery.

Changing a Mains Fuse



Always replace a damaged fuse with the correct rating i.e. 2x315mA for 110V working.

To change a fuse press the two retaining lugs on side of the fuse panel (situated below the mains connector on the back panel). Remove the fuse panel and replace the fuse(s). Click back the fuse panel.

Safety Notices



- Before using the unit, ensure that an introduction regarding the unit functions and the safety precautions has been provided by a product representative.
- This product is not designed for sterile use.
- This product is not designed for internal use.
- This product is not designed for outdoor use.
- Surface temperature of applied parts must not exceed 41°.
- Use only accessories and other parts recommended or supplied by SCHILLER AG. Use of other than recommended or supplied parts may result in injury, inaccurate information and/or damage to the unit.
- Do not use high temperature sterilization processes (such as autoclaving). Do not use e-beam or gamma radiation sterilization.
- Do not use solvent or abrasive cleaners on either the unit or cable assemblies.
- Do not, under any circumstances, immerse the unit or cable assemblies in liquid.
- To prevent electric shock do not disassemble the unit. No serviceable parts inside. Refer servicing to qualified personnel only.
- To prevent electric shock do not disassemble the unit. No serviceable parts inside. Refer servicing to qualified personnel only.
- Do not use this unit in areas where there is any danger of explosion or the presence of flammable gases such as anaesthetic agents.

Safety Notices



- Switch the unit off before cleaning and disconnect from the mains.
- Do not, under any circumstances, immerse the unit or cable assemblies in liquid.
- The device must only be operated using battery power if the earth connection is suspect or if the mains lead is damaged or suspected of being damaged.
- The AT-2 complies with emc regulations for medical products which affords protection against emissions and electrical interference. However special care must be exercised when the unit is used with high frequency equipment.
- It must be ensured that neither the patient nor the electrodes (including the neutral electrode) come into contact with other persons or conducting objects (even if these are earthed).
- There is no danger when using the ECG unit for a **pacemaker patient** or with simultaneous use of other electrical stimulation equipment. However, the stimulation units should only be used at a sufficient distance from the electrodes. In case of doubt, the patient should be disconnected from the recorder.
- This unit is cf classified according to iec 601-1. This means that the patient connection is fully isolated and defibrillation protected. SCHILLER can only guarantee protection against defibrillation voltage however, when the original SCHILLER patient cable is used.
- If several units are coupled there is a danger of summation of leakage current
- Do not touch the casing during defibrillation.
- if the patient cable should become defective after defibrillation, lead off will be displayed and an acoustic alarm given.

Symbols and Conventions Used in this User Guide



WARNING:

Specific warning applicable to associated instruction. Text set off in this manner indicates that failure to follow directions could result in bodily harm or loss of life.

NOTE:

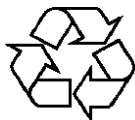
Text set off in this manner presents clarifying information, specific instructions, commentary, sidelights, or interesting points of information.



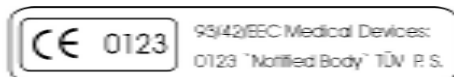
CF Symbol. Unit is classified safe for internal and external use. The paddles at the side indicate that the unit is defibrillation protected when the original SCHILLER patient cable is used.



Potential Equalisation Point.



The unit /component can be recycled.



Type and approving body.

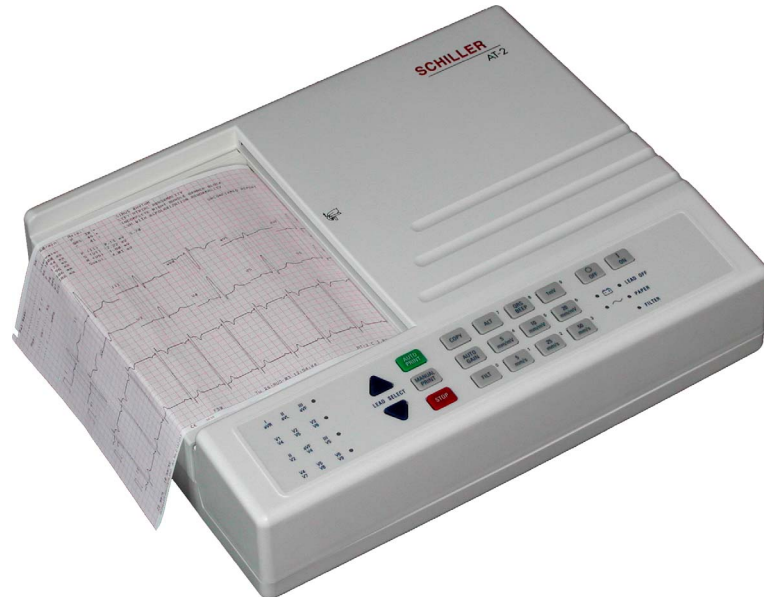
Introduction

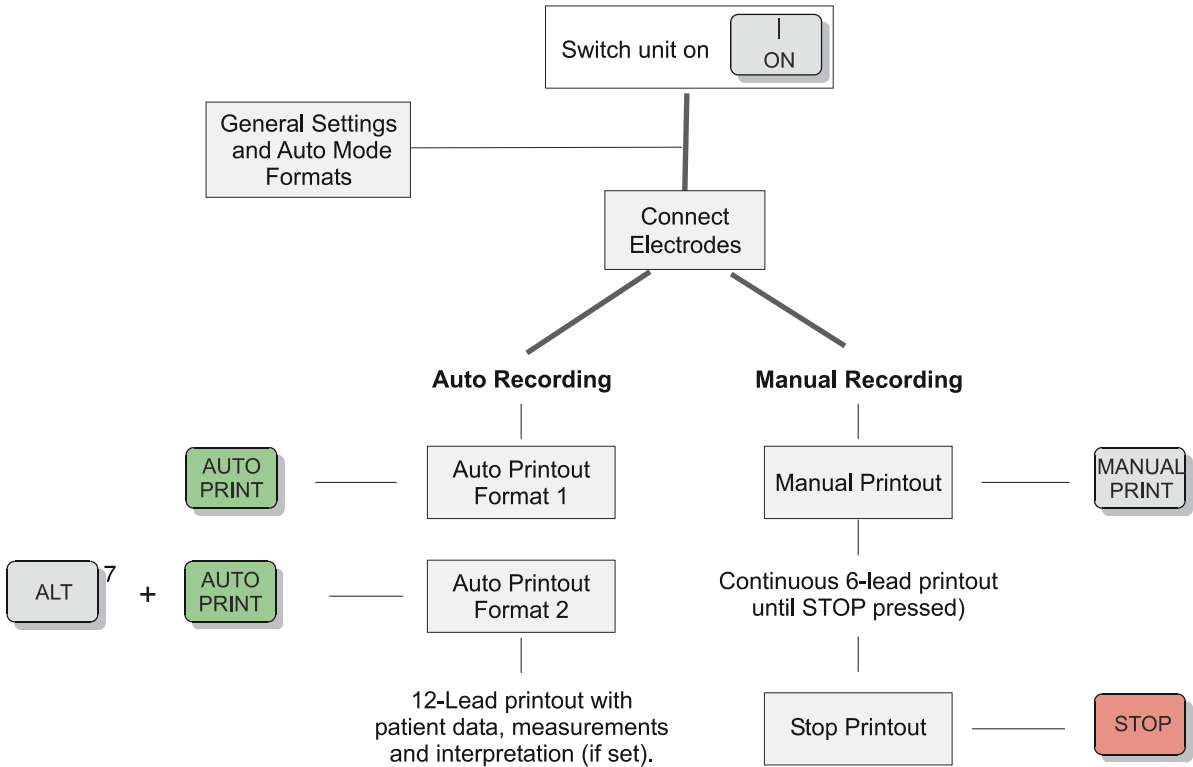
The SCHILLER Cardiovit AT-2 is an ECG recorder with all (12) ECG signals simultaneously processed to provide instant ECG recordings. Two automatic recording modes can be individually preset to enable one button ECG recording of preferred print formats.

Individual lamps are provided to give power, paper error, filter, lead group and lead off indications. In addition, any detected disturbance (i.e. loose electrode or end of paper), gives an audible alarm and the corresponding indicator lamp flashes.

The AT-2 includes the following features:

- Low weight and compact dimensions.
- Large A4 size printout from integrated quality thermal printer.
- Built-in rechargeable battery for mains-independent use - 4hrs normal use or 300 printouts on one battery charge.
- Simple one key operation for main functions.
- Automatic or manual recording modes.
- Selectable printing formats
- Interpretation program option (including measurements) for children and adults.





Modes of Operation

Automatic Mode

Automatic Mode provides a printout giving 10 seconds of ECG recording of all 12 leads with a choice of 2 different formats.

The following can be programmed freely for each of the 2 formats before recording:

- Lead Format
- Chart Speed
- With the optional interpretation program installed it is also possible to select the measurement table, average cycles with optional markings and interpretation statements for the printout.

For further information see sections `Operating Overview` and `Settings for Automatic Mode`.

Manual Mode

Manual Mode provides a real time printout of 6 leads that are selected and indicated on the screen.

The following can be freely selected before or during recording:

- Lead Group
- Chart Speed
- Sensitivity
- Myogram Filter

For further information see section `Operating Overview` - Manual Mode.

Location & Power

Location

Do not keep or operate the apparatus in a wet, moist, or dusty environment. Also, avoid exposure to direct sunlight or heat from other sources. Do not allow the unit to come into contact with acidic vapours or liquids, as such contact may cause irreparable damage. The unit should not be placed near X-ray or diathermy units, large transformers or motors. The unit must be placed on a flat surface and must not be operated in areas where there is any danger of explosion.

Power Supply

The unit can either be operated from the built-in rechargeable battery, or from the mains. The mains connection is on the rear of the unit. The mains indicator lamp is always lit when the unit is connected to the mains supply.

A battery indicator lamp confirms battery operation. When battery capacity is limited, the battery symbol flashes on and off.

To recharge the battery, connect the apparatus to the mains supply by means of the supplied power cable. A totally discharged battery needs less than 15 hours to be fully recharged (60% in less than 3 hours, 90% in less than 7 hours). A fully charged battery gives approximately 4 hours of normal use. The unit can remain connected to the mains supply without any danger of damage to either the battery or the unit.

Switching On and Off

The Cardiovit AT-2 is switched on with the ON key



and off by means of the OFF key



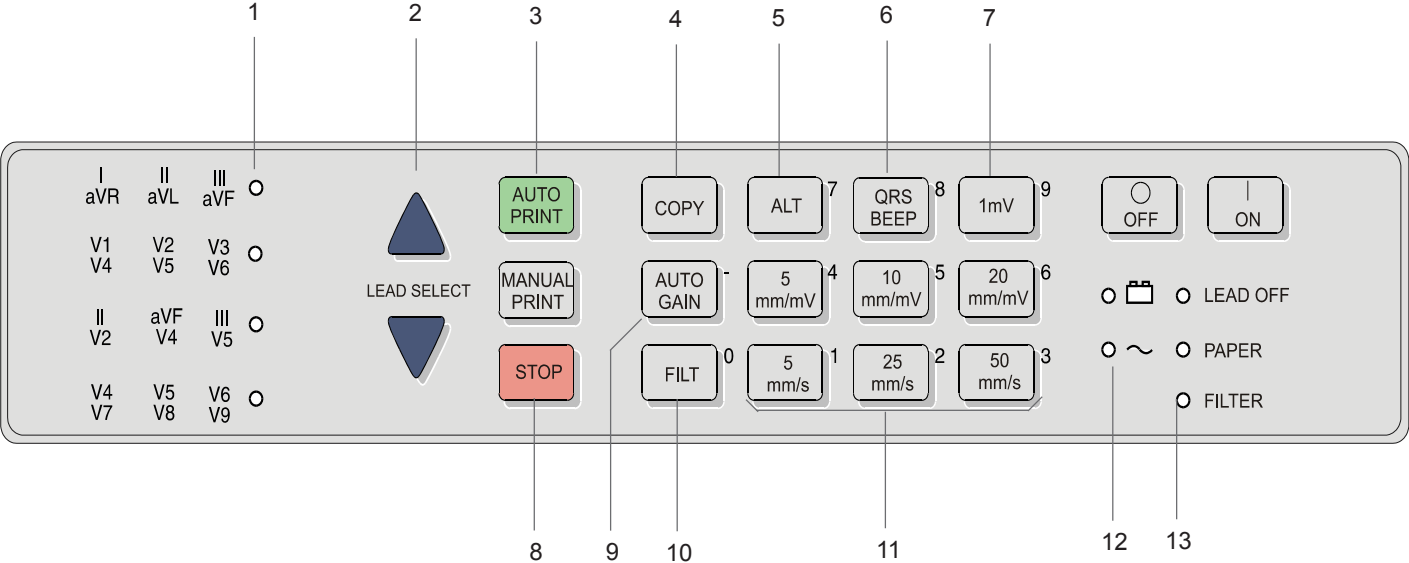
The unit is automatically switched off after 5 minutes (30 seconds if battery capacity is limited) if no key is pressed and the patient cable is not connected.

Potential Equalisation



If the AT-2 is used in conjunction with other patient connected equipment, we recommend that the potential equalisation stud on the rear of the unit is connected to the hospital/ building common ground with the yellow/green ground cable (Part-no. 2.310005). When working from an emergency vehicle, the vehicle common ground can be used.

Keyboard



Keyboard

1. LED indicator showing the lead group that will be (is being) printed in manual mode.
2. Changes the lead group for the printout.
3. Auto Mode recording (in Auto mode 1). Press ALT followed by the AUTO key for auto mode 2.
- 4* Print extra copy - *of Auto mode recording currently in memory*. Press the ALT key first followed by this key to obtain a copy in Auto format 2.
5. ALT key - key for initiation of setups and selection of second format for printout and auto mode recording
6. Toggles the QRS beeper ON/ OFF
7. Stabilizes baseline on the printout and inserts a 1mV reference pulse on the printout
8. Manual mode recording - start continuous printout of ECG - until STOP key pressed. The STOP key is also used to confirm (a new) setting.
9. Auto sensitivity key - automatically sets the ECG printout sensitivity (in AUTO mode only) to the best setting for the signal strength (5mm/mV or 10mm/mV)
- 10* Myogram filter ON / OFF. The cutoff frequency can be defined and is detailed in `Settings`.
- 11* Change the speed and sensitivity of the printout in manual mode.
12. Mains and battery Indicator. Mains indicator always lit when mains connected. Battery indicator lit when working from battery power. (flashes when battery capacity limited).
13. LED indicators to indicate:
 - LEAD OFF lead off or high resistance reapply the electrode
 - PAPER Paper Jam or paper tray empty - replace paper
 - FILTER Myogram filter applied.

* The numbers by the side of these keys are used when programming AT-2 system settings and auto mode formats etc. System settings are detailed later in this guide.

Patient Cable Connections



WARNING

In the case of a lead-off during ECG acquisition, (indicated acoustically, and/or on the printout), the resultant printout and interpretation if given, cannot be used for diagnosis. The electrodes must be reapplied and a new ECG must be carried out.

The accessory kit of the electrocardiograph includes a 10-lead patient cable. This cable is plugged into the patient cable socket on the right-hand side of the unit and secured with the two screws.

The Cardiovit AT-2 is CF rated. The patient connection is fully isolated and defibrillation protected. Protection against defibrillation voltage is however only ensured, if the original SCHILLER patient cable (Part-no.2.400071) is used. Make sure that during ECG recording neither the patient nor the conducting parts of the patient connection or the electrodes (including the neutral electrode) come into contact with other persons or conducting objects (even if these are earthed).

Patient Cable Connections

The quality of the ECG is dependent on the preparation and the resistance between the skin and the electrode. To ensure a good quality ECG and minimise the skin/electrode resistance, remember the following points:

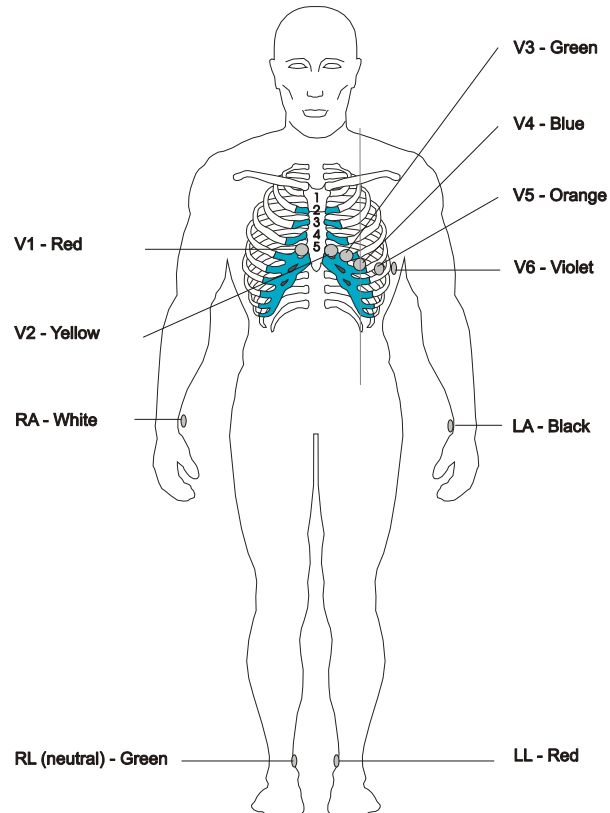
1. Ensure that the patient is warm and relaxed.
2. Shave electrode area before cleaning.
3. Thoroughly clean the area with alcohol.
4. Place the C4 electrode first - in the fifth intercostal space on midclavicular line. Then place:
 - C1 in fourth intercostal space at the right sternal border
 - C2 in fourth intercostal space at the left sternal border
 - C3 between, and equidistant to, C4 and C2
 - C6 on left midaxillary line on the same level as C4
 - C5 between, and equidistant to, C4 and C6

Electrodes and Neutral Electrodes Identification and Color Code

The electrode placements shown in this handbook are labelled with the colors according to Code 2 requirements. The equivalent Code 1 colors are given below.

System	CODE 1 (Usually European)		CODE 2 (Usually American)	
	Electrode Identifier	Color Code	Electrode Identifier	Color Code
Limb	R	Red	RA	White
	L	Yellow	LA	Black
	F	Green	LL	Red
Chest according to Wilson	C	White	V	Brown
	C1	White/Red	V1	Brown/Red
	C2	White/Yellow	V2	Brown/Yellow
	C3	White/Green	V3	Brown/Green
	C4	White/Brown	V4	Brown/Blue
	C5	White/Black	V5	Brown/Orange
	C6	White/Violet	V6	Brown/Violet
Position according to Frank	I	Light blue/red	I	Orange/red
	E	Light blue/yellow	E	Orange/yellow
	C	Light blue/green	C	Orange/green
	A	Light blue/brown	A	Orange/brown
	M	Light blue/black	M	Orange/black
	H	Light blue/violet	H	Orange/violet
Neutral	F	Green	F	Green
	N	Black	RL	Green

Electrode Placement - Standard Configuration



Operating Overview

Automatic Mode

In **automatic mode**, a full 12-lead ECG is printed in one of two predefined formats with a sensitivity of 10 mm/mV. These two formats are selected by the user to suit his specific needs and requirements.



NOTE:

To reduce the possibility of overlapping traces, an auto sensitivity reduction is applied in Auto Mode (default). This means that the unit detects very large waveform amplitudes and sets the sensitivity for the extremity and/or precordial leads to 5 mm/mV. An `A` on the bottom line of the LCD indicates that Auto sensitivity is set.

To disable this function, the AUTO GAIN key must be pressed.

To start the automatic ECG recording in Format 1, press the AUTO key:



To start the automatic recording in the second format, press the ALT key followed by the AUTO key:



Operating Overview

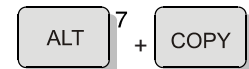
The printout gives the following:

- ECG recording of all leads in either Standard or Cabrera format according to selection
- Sensitivity
- Heart Rate
- Speed
- Filter Settings
- Time and Date
- Interpretation statements
- Average Cycles
- Intervals
- Axis
- Sokolow Index (ECG index for hypertrophy)
- Detailed Measurement Table

To obtain an extra printout of the ECG recording in Format 1, simply press the COPY key



To obtain an extra printout of the second format, press the ALT key followed by the COPY key



The Auto mode settings for the two formats are detailed in the paragraph entitled 'Settings for Automatic Mode' later in this book

Operating Overview

Manual Mode

Manual mode provides a direct printout of the real-time ECG with full control of parameter selection.

To start the manual recording of a real-time ECG, press the MANUAL Printout key



To stop the manual recording (printout) press the STOP key



The printout provides you with the following:

- Six (selected) leads with lead identification.
- On the lower edge, the chart speed, user identification and filter settings (if on).
- At the top, the heart rate as current average of 4 beats, trace sensitivity, and the time and date

Operating Overview

Changing the Lead Group

The following can be freely chosen during the recording:

Lead Group by means of the LEAD FORWARD and LEAD BACKWARD key



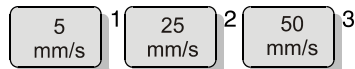
The following lead groups are selectable:

- | | | |
|----------------|---|------------------------|
| ° I, II, III | / | aVR, aVL, aVF |
| aVL, I, -aVR | / | II, aVF, III (Cabrera) |
| ° V1, V2, V3 | / | V4, V5, V6 |
| ° II, aVF, III | / | V2, V4, V5 |
| ° V4, V5, V6 | / | V7, V8, V9 |

Operating Overview

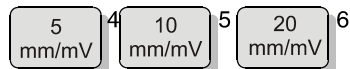
Chart Speed

Select speed 5, 25 or 50mm/s by means of the SPEED keys:



Sensitivity

Select 5, 10 or 20 mm/mV by means of the SENSITIVITY keys:



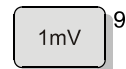
Myogram Filter

Switch the filter ON or OFF with the FILTER key:



Recentering

To re-centre the ECG traces, press the 1mV key



Settings

Each parameter is set by means of a code. This code comprises a combination of keys starting with the **ALT** key followed by two or three numbers. The setting is confirmed with the **STOP** key. As soon as the **ALT** key is pressed, the keyboard is dedicated to the programming function.



NOTE

The Alternative (ALT Key pressed) function is only active for 4 seconds. If a programming key is not pressed within 4 seconds, the unit reverts to standard mode. The ALT key must again be pressed to activate the programming mode

The setting is remembered and the keyboard released for other functions when the **STOP** key is pressed. Once a setting has been confirmed, it is stored in the memory even when the unit is switched off.

On the following pages the programmable parameters and the programming sequences are described in detail.

Settings

The defined formats and settings that are set for your unit can be checked as follows:

Setup Printout				
Entry Key Sequence				Result
ALT	0	1	1	Printout of programmed Settings

A printout of the defined settings will be produced and gives the following information, depending on the installed software:

Unit designation	Software option installed (C = Interpretation) and Software version
Serial number	Serial number of the unit
Leads	Standard (S) or Cabrera (C)
ECG Format	Long (ooo), Short (o) or Suppressed (-)
MECG	Average cycles as defined in auto ECG recording setup (e.g. $4 * 3$ (25 mm/s) + 2)
Measurements	Enabled (+) or Suppressed (-)
Marks	Enabled (+) or Suppressed (-)
Interpretation	Enabled (+) or Suppressed (-)
Selected Rhythm leads	Leads selected for R1, R2 resp.
Automatic Centering	Enabled (+) or Suppressed (-)

Settings

Printout of signals	Sequential or Simultaneous
Baseline Filter	0.05, 0.15 or 0.30 Hz
Mains Filter	50, 60 Hz or OFF (-)
Myogram Filter	25 or 35 Hz, ON (+) or OFF (-)
Interpretation settings:	<p>N/A: +/- 'normal/abnormal' is written (+) or suppressed (-)</p> <p>U: +/- 'unconfirmed report' is written (+) or suppressed (-)</p> <p>A30: +/- patient age is assumed to be < 30 (-) or >30 (+)</p> <p>S: +/- low (-) or high (+) sensitivity</p>

Default Settings

To reset the unit to the basic default settings, proceed as follows:

Reset to Default Settings				
Entry Key Sequence				Result
ALT	0	6	6	Reset to default settings

Settings

SETTINGS	STANDARD	WITH INTERPRETATION
LANGUAGE	AS SET	AS SET
LEADS	STANDARD (S)	STANDARD (S)
AUTO FORMAT 1	ECG: 25MM/S, SHORT (O)	ECG : 25MM/S, SHORT (O)
		MECG: 2*6 (50MM/S + 1)
		MEASUREMENTS: SUPRESSED (-)
		INTERPRETATION: ENABLED (+)
		MARKS: ENABLED (+)
AUTO FORMAT 2	ECG: 25MM/S, LONG (OOO)	ECG : 25MM/S, LONG (OOO)
		MECG: NONE
		MEASUREMENTS: SUPRESSED (-)
		INTERPRETATION: DISABLED (-)
		MARKS: ENABLED (+)
RHYTHM LEADS	V1	V1, II
AUTOM. CENTERING	ENABLED (+)	ENABLED (+)
PRINTOUT OF SIGNALS	SEQUENTIAL	SEQUENTIAL
BASELINE FILTER SETTING	0.05HZ	0.05HZ
MAINS FILTER SETTINGS	50HZ (60HZ)	50HZ (60HZ)
MYOGRAM FILTER SETTING	35HZ, OFF	35HZ, OFF
INTERPRETATION SETTINGS		N/A: SUPRESSED (-)
		U: ENABLED (+)
		A30: UNDER THIRTY (-)
		S: LOW (-)

Settings

Language

Set the unit language as follows:

Language Selection					
Entry Key Sequence				Language	Confirm
ALT	0	2	1	German	Press STOP key
			2	English	
			3	French	
			4	Swedish	
			5	American	
			6	Italian	
			7	Spanish	
			8	Portugese	
			9	Russian	

NOTE:

The difference between `English` and `American` is as follows:

American

measurements in inches
temperature in Fahrenheit
mains filter setting - 60Hz
date order mm-dd-yy

Standard English

measurements in centimetres
temperature in degrees centigrade.
mains filter setting - 50Hz
date order dd-mm-yy

Settings

Filters

There are three different filters which can be set individually as follows:

- Baseline filter
- Mains filter
- Myogram filter

The setting for each filter is given on the setup printout.

Settings

Baseline

Baseline Filter

The baseline filter greatly reduces the baseline fluctuations without affecting the ECG signal. The purpose of the this filter is to keep the ECG-signals on the baseline of the printout. This filter is only effective in auto mode printout.

Baseline Filter				
Entry Key Sequence			Filter Setting	Confirm
ALT	5	0	0.05 Hz (default)	Press STOP key
		1	0.15 Hz	
		3	0.30 Hz	

Note: The set value is the lower limit of the frequency range and is normally set to 0.05 Hz. The settings 0.15 and 0.30 Hz should only be used when absolutely necessary, as the possibility exists that they could affect the original ECG signal, especially the ST segments.

Settings

Mains Filter

The **Mains filter** is an adaptive digital interference filter designed to suppress AC interference without attenuating or distorting the ECG.

Set the mains filter in accordance with the frequency of your local mains supply as follows:

Mains Filter				
Entry Key Sequence			Filter Setting	Confirm
ALT	8	5	Mains Filter 50 Hz	Press STOP key
		6	Mains Filter 60 Hz	
		9	Mains Filter Off	

Myogram Filter

The **Myogram filter** suppresses disturbances caused by strong muscle tremor. The set value will be the new upper limit of the frequency range as soon as the **FILTER** key is pressed on or programmed as default when the unit is switched on. When the Myogram filter is on `Filter` is displayed on the bottom line of the LCD.

Settings

Myogram Filter				
Entry Key Sequence			Setting	Confirm
ALT	8	2	Myogram Filter 25 Hz	Press STOP key
		3	Myogram Filter 35 Hz	
		1	Myogram Filter active when the unit is first switched on (marked on printout with +)	
		8	Myogram Filter off when the unit is first switched on (marked on printout with -)	

Confirm the selection by pressing the **STOP** key.

The myogram filter is switched on and off manually with the **FILTER KEY**



Note: An ECG recorded in auto mode is stored unfiltered. It is therefore possible to print the stored ECG either with or without passing the myogram filter. Filter ON is indicated in the bottom information line of the LCD. When the **FILTER** key is pressed again, the filter is switched off and the 'Filter' indication on the bottom information line of the LCD is removed. The cutoff frequency of the myogram filter is set to either 25 or 35 Hz.

Settings

Defining Lead Sequence & Printout

The required settings can be selected as follows:

Sequences, Print & Auto-centering				
Entry Key Sequence			Definition	Confirm
ALT	7	1	Standard Lead Sequence	Press STOP key
		2	Cabrera Lead Sequence	
		3	Simultaneous Print	
		4	Sequential Print	
		5	Auto-centering ON	
		6	Auto-centering OFF	

Confirm the selection by pressing



Settings

The selectable printout forms are:

Simultaneous All ECG leads are printed in the same time segment (in automatic mode only).

Sequential Each group is a contiguous time segment of approximately 2.5 or 5 seconds (in automatic mode only).

Auto-Centering ON All ECG traces are centred dynamically for optimal use of paper width.

Auto-Centering OFF ECG traces are set to a fixed baseline position and may possibly overlap.

The Standard and Cabrera lead groups available for the AT-2 are:

Lead Groups							
Standard				Cabrera			
I	V1	II	V4	aVL	V1	II	V4
II	V2	aVF	V5	I	V2	aVF	V5
III	V3	III	V6	-aVR	V3	III	V6
aVR	V4	V2	V7	II	V4	V2	V7
aVL	V5	V4	V8	aVF	V5	V4	V8
aVF	V6	V5	V9	III	V6	V5	V9

Settings

Acoustic QRS Indication

The acoustic QRS beep can be switched on or off at any time by pressing the QRS key



Time / Date

The required settings can be selected as follows:

Setting the Time and Date						
	Key Sequence				Enter Data	Confirmation
Time	ALT	9	1	1	HHMMSS	beep
Date	ALT	9	2	2	DDMMYY	beep

Seasonal Time Variation				
Key Sequence				
Wintertime to Summertime (+1Hr)	ALT	9	4	4
Summertime to Wintertime (-1Hr)	ALT	9	5	5

Automatic Mode (ECG) Settings

Two separate Auto formats can be defined for the AT-2. When defining auto format 1 the key sequence ALT `1` precedes the setting. When defining auto format 2 the key sequence ALT `2` precedes the setting.

Automatic ECG Format		
Entry Key Sequence		Setup Format
ALT	1	Commence Setup for Auto format 1
	2	Commence Setup for Auto format 2

Automatic Mode (ECG) Settings

The automatic mode formats are detailed on the following pages. The ECG format is set as follows:

ECG Format					
Entry Key Sequence			Printout	Confirm	
ALT	1 or 2	1	1	1page x 12 leads at 25mm/s	Press STOP key
			2	One page with the first 8 leads printed for 5s and the last 4 leads printed for 10s	
			5	No leads printed	
			6	Leads are printed in short form (1 sheet)	
			7	Leads are printed in long form (2 sheets)	
			8	Chart Speed 25mm/s	
			9	Chart Speed 50mm/s	
			0	Leads are printed in format 4 * 3(25mm/s) + 1 rhythm(25mm/s)	

Automatic Mode (ECG) Settings

Average Cycles

The printout format for the Average cycles are given on the table

Average Cycles (C version only)					
Entry Key Sequence				Printout	Confirm
ALT	1 or 2	2	5	No average lead cycles are printed	Press STOP key
			6	4 x 3 (25 mm/s) + 2 rhythm leads (25mm/s). The average complexes are printed in 4 groups of three leads at a chart speed of 25mm/s	
			7	4 x 3 (50 mm/s) + 2 rhythm leads (25mm/s). The average complexes are printed in 4 groups of three leads at a chart speed of 50mm/s	
			8	2 x 6 (50 mm/s) + 2 rhythm leads (25mm/s). The average complexes are printed in 2 groups of six leads at a chart speed of 50mm/s	

Automatic Mode (ECG) Settings

Measurements and Markings (C version only)

To define the measurements and markings proceed as follows:

Measurements (Interpretation Option Only)					
Entry Key Sequence				Printout	Confirm
ALT	1 or 2	3	5	Detailed table of measurement results omitted - however, the values of electrical axes, intervals, and heart rate are not suppressed.	Press STOP key
			6	Detailed table of measurement results is printed	
			7	Referenece markings are omitted	
			8	Reference markings (beginning and end of P wave and QRS, and end of T wave) are added to the ECG average cycles	

Automatic Mode (ECG) Settings

Interpretation (C version only)

To print or suppress interpretation statements on the printout proceed as follows:

Interpretation (Interpretation Option Only)					
Entry Key Sequence				Printout	Confirm
ALT	1 or 2	4	5	Interpretation is omitted	Press STOP key
			6	Interpretation is printed	

Full details of the interpretation option are given in the SCHILLER ECG Measurement and Interpretation booklet (art. No. 2.510 179).

Automatic Mode (ECG) Settings

Interpretation Settings (C version only)

The interpretation settings enable the user to determine whether or not certain comments will be added to the interpretation statements on the ECG printout. Furthermore, the patient's age can be defined (<30 or >30) and if low or high sensitivity should be applied. Low sensitivity will suppress certain nonspecific ECG diagnosis; this may be advisable when carrying out ECGs for screening.

Interpretation Settings				
Entry Key Sequence			Setting	Confirm
ALT	6	1	"Normal" / "Abnormal" is not printed	Press STOP key
		2	"Normal" / "Abnormal" is printed	
		3	"Unconfirmed report" is not printed	
		4	"Unconfirmed report" is printed	
		5	Patient age assumed to be < 30	
		6	Patient age assumed to be > 30	
		7	Low sensitivity	
		8	High sensitivity	

Automatic Mode Settings

Selecting Rhythm Leads

The rhythm leads are printed out as defined. Two separate rhythm leads can be selected. The following formats can be set:

Rhythm Leads (interpretation option only)		
Entry Key Sequence		Setup Format
ALT	3	Define Rhythm lead one
	4	Define Rhythm lead two

Automatic Mode Settings

The 2 rhythm leads are defined as follows:

Extremity Leads					
Entry Key Sequence				Lead	Confirm
ALT	3 or 4	8	1	I	Press STOP key
			2	II	
			3	III	
			4	aVR	
			5	aVL	
			6	aVF	

Precordial Leads					
Entry Key Sequence				Lead	Confirm
ALT	3 or 4	9	1	V1	Press STOP key
			2	V2	
			3	V3	
			4	V4	
			5	V5	
			6	V6	

Care & Maintenance

Self-test

Initiate a self-test of the AT-2 as follows:

Self Test				
Entry Key Sequence				Action
ALT	0	3	3	Service Data Displayed

A table giving information for the service staff is displayed.

To obtain a printout press `P` when the table is displayed. Exit this screen by pressing the ENTER key.

12 Monthly Check

The unit should undergo a technical safety check every 12 months. This safety check should include the following:

- Visual inspection of the unit and cables.
- Electrical safety tests according to IEC 601-1 and IEC 601-2-25.
- Functional tests according to the Service Handbook.

The test results must be documented.

Care & Maintenance

Cleaning the Casing



WARNING

Switch the unit off before cleaning and disconnect the mains. Do not, under any circumstances, immerse the apparatus into a cleaning liquid or sterilize with hot water, steam, or air.

The casing of the AT-2 can be cleaned with a soft damp cloth on the surface only. Where necessary a domestic non-caustic cleaner can be used for grease and finger marks.

Care & Maintenance

Cleaning the Patient Cable

**WARNING**

Align the leads in such a way as to prevent anyone stumbling over them or any damage caused by the wheels of instrument trolleys.

The patient cable should not be exposed to excessive mechanical stress. Whenever disconnecting the leads, hold the plugs and not the cables. Store the leads in such a way as to prevent anyone stumbling over them or any damage being caused by the wheels of instrument trolleys.

The cable can be wiped with soapy water. Sterilization, if required, should be done with gas only and not with steam. To disinfect, wipe the cable with hospital standard disinfectant.

Cleaning the Thermal Print Head

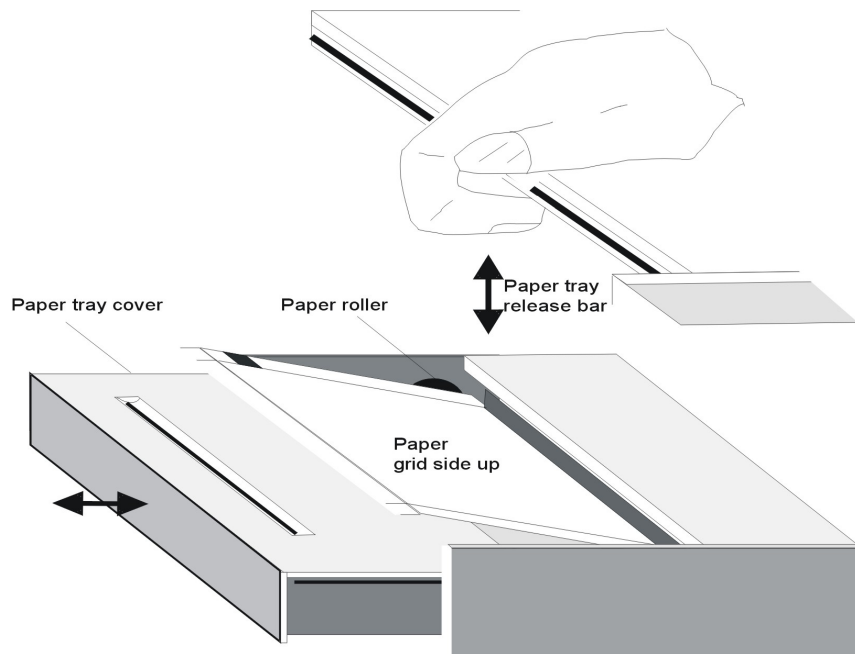
When the printer is used a lot, a residue of printers ink (from the grid on the paper) can build up on the print head. This can cause the print quality to deteriorate. We recommend therefore that every month the print head is cleansed with alcohol as follows:

Remove the paper tray. The thermal printhead is found under the paper tray release catch.

With a tissue dampened in alcohol, gently rub the printhead to remove the ink residue. If the printhead is badly soiled, the colour of the paper grid ink (i.e. red or green) will show on the tissue.

Replacing the Recording Paper

The recording paper must be replaced as soon as the end of the paper is indicated by a red stripe on the lower edge. After the indication first appears, there are about 8 pages left. However, we recommend that the paper be replaced immediately. If no paper is left, the printing process is interrupted and a warning is given by an audible beep. To replace the paper proceed as follows:



Replacing the Recording Paper

- Place fingers under the retaining bar and pull directly upwards. The paper tray cover releases.
- Withdraw the cover from the unit. DO NOT FORCE, THE PAPER TRAY COVER RUNS FREELY OVER THE DEDICATED RUNNERS.
- Remove any remaining paper from the paper tray.
- Place a new paper pack into the paper tray with the printed (grid) side facing upwards.
- Place the beginning of the paper over the black paper roller on the paper tray cover.
- Return the paper tray cover in position and press firmly until secure.
- Press the STOP key to transport the paper to the start position.
SCHILLER can only guarantee perfect printouts when SCHILLER original chart paper or chart paper of the same quality is used.

Thermal Paper Handling

The thermal paper used in the AT-2 requires slightly different handling to normal paper as it can react with chemicals and to heat. However, when the following points are remembered, the paper will give reliable results:

The following points apply to both storage, and when archiving the results.

- Before use, keep the paper in its original cardboard cover. Do not remove the cardboard cover until the paper is to be used.
- Store in a cool, dark and dry area.
- Do not store near chemicals e.g. sterilisation liquids.
- In particular do not store in a plastic cover.
- Certain glues can react with the paper - do not attach the printout onto a mounting sheet with glue.

Fault Diagnosis

Unit does not switch on,

Green mains indicator on?

No? Check mains supply.

Yes? Press the OFF key

Wait a few seconds and switch on again.

Check fuses - Call your local SCHILLER representative.

QRS traces overlap

Ensure that the automatic sensitivity reduction is not switched off.

Reset signals to baseline - press the 1mV key

Check electrode contact

'Noisy' traces

Check electrode contact

Reapply electrodes

Ensure that the patient is relaxed and warm

Check all filter settings.

Activate Myogram filter - change cutoff frequency

Ensure mains filter is correct for mains supply

Fault Diagnosis

No printout obtained after an auto mode recording

Ensure that paper is loaded.

Check Settings - ensure that at least one item is selected for print after an auto ECG is recorded

Contact your local SCHILLER representative.

Printout fades or is not clear

Ensure that fresh SCHILLER paper is installed.

Note that the thermal paper used for the AT-2 is heat and light sensitive. If is not stored in its original seal, stored in high temperatures or is simply old, print quality can deteriorate.

Ensure that the paper has been installed correctly with the paper mark at the top.

Over a period of time, the printing ink from the grid on the paper can form a film on the thermal print head. Clean the thermal print head with a clean cloth as described previously.

If the problem persists call your local SCHILLER representative.

No printout of interpretations statement or measurements

Check that the interpretation and measurement options are enabled for the printout.

No key response

Switch off, and switch on again after a few seconds

Ordering Information

Your local representative stocks all the disposables and accessories available for the AT-2. In case of difficulty or to obtain the address of your local dealer, please contact the head office. Our staff will be pleased to help process your order or to provide any details for all SCHILLER products.

DESCRIPTION	PART-NO.
10-lead Patient Cable, USA	2.400 071
Electrodes (box of 500 clip electrodes)	2.155 031
Mains (Power) Cable (USA)	2.300 001
Potential Equalisation (Ground) cable	2.310 005
Recording Paper, Z-folded	2.157 017
AT-2 User Guide	2. 510 512
AT-2 Reference Sheet	2. 510 514
Software (C) Interpretation	5. 025 002
Guide to the Interpretation and Measurements Program	2.510 179

Technical Data

Technical data subject to change without notice.

Dimensions	400 x 330 x 100 mm
Weight	5.0 kg (5.35 kg with full paper tray)
Mains Supply	100 to 115 / 220 to 240 VAC, 50/60 Hz
Battery	Built-in 12 V lead-acid battery (rechargeable)
Battery Capacity	4 hours normal use - 300 printouts
Power Consumption	Recording: 28 VA max
Leads	Standard / Cabrera
Paper Speed	5 / 10/ 25 / 50 mm/s (direct)
Sensitivity	5 /10 / 20 mm/mV, either automatically adjusted or manually selected
Chart Paper	Thermoreactive - Z-folded, 210 mm wide, perforation 280 mm
Printing Process	High-resolution thermal print head, 8 dots per mm / 200 dots per inch (amplitude axis) 40 dots per mm / 1000 dots per inch (time axis 25mm/s)
Recording Tracks	6 channels, positioned at optimal width on 200 mm, automatic baseline adjustment
Automatic Lead Programs	Printout of all 12 leads
Data Record:	Listing of ECG recording data <i>Version C: ECG measurement results (intervals, amplitudes, electrical axes), Sokolow Index, average complexes with optional measurement reference markings, and interpretation.</i>

Technical Data

ECG Storage:	Circular input memory for 10 s, 12-lead ECG.
Frequency Range of Digital Recorder:	
	0 to 150 Hz (IEC)
	0 to 150 Hz (AHA)
ECG Amplifier:	Simultaneous, synchronous registration of all 9 active electrode signals (= 12 standard leads)
	Sampling frequency: 1000 Hz
	Digital resolution: 5 μ V
	Dynamic range: ± 9.5 mVAC
	Max. electrode potential: ± 300 mVDC
	Time constant: 3.2 s
	Frequency response: 0.05 to 150 Hz (-3 dB)
	Input impedance: >2.5 MOhms at 10Hz
Myogram Filter (muscle tremor filter)	
	25 Hz or 35 Hz, programmable (not active on averaged waveform). The stored ECGs can be printed with or without filter.
Line Frequency Filter:	Distortion-free suppression of superimposed 50 or 60 Hz sinusoidal interferences by means of an adaptive digital filter.

Technical Data

Patient Input:	Fully floating and isolated, defibrillation protected.
Safety Standard:	CF according to IEC and complying with the following
	RL 93/42/EEC
	EN 60601-1:1990
	IEC 601-1
	IEC 601-2-25:1993
	pr EN 1441:1994
EMC:	CISPR 11: 1985, EN 55011: 1992
	IEC 801-2: 1991
	IEC 801-3: 1984
	IEC 801-4: 1988
	IEC 801-5:
Safety Class:	I according to IEC 601-1 (with internal power supply)
	Ila according to RL 93/42/EEC, CE-0123
	This device is not designed for outdoor use (IP 20)

Technical Data

Environmental Conditions:	
	Temperature, Operating: 10° to 40°C
	Temperature, Storage: -10° to 50° C
	Relative humidity: 25 to 95% (non condensing)
	Atmospheric pressure: 700 to 1060 hPa
Control Panel:	Rubber keys

Technical data subject to change without notice.

Available Configurations

The Cardiovit AT-2 is available in two versions:	
Standard Version:	Unit with ECG recording and printout capabilities.
Version C:	Unit with additional ECG Interpretation program (including measurements).